

Decision 03-12-036 December 18, 2003

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking on the
Commission's Proposed Policies and Programs
Governing Energy Efficiency, Low-Income
Assistance, Renewable Energy and Research
Development and Demonstration.

Rulemaking 98-07-037
(Filed July 23, 1998)

**INTERIM OPINION DENYING THE INCLUSION OF TURBO-EXPANDERS IN
THE ASSEMBLY BILL 970 SELF-GENERATION PROGRAM**

1. Introduction and Summary

By Decision (D.) 01-03-073, dated March 27, 2001, the Commission adopted program incentives for demand-responsiveness and self-generation, pursuant to Assembly Bill (AB) 970.¹ In D. 03-01-006, we considered a Petition for Modification of D.01-03-073 filed by Mafi-Trench Corporation U.S.A. (Mafi-Trench) to include expansion turbines (turbo-expanders) in the AB 970 self-generation incentive program. Turbo-expanders may be used in place of throttling valves to step down high-pressure, transmission-level natural gas to lower pressures for customer usage at distribution level. The recovery of excess pressure can be used to produce electrical power.

¹ D.01-03-073 has subsequently been corrected by D.01-04-048 and modified by D.01-07-028, D.02-02-026, D.02-04-004, D.02-09-051 and D.03-01-006 in response to petitions for modification.

We found that Mafi-Trench's Petition left several questions unanswered concerning this technology, and raised several concerns about its inclusion in the incentive program. We denied the Petition at the time but we afforded Mafi-Trench the opportunity to respond to our concerns by answering several questions. We directed Energy Division to develop recommendations for our consideration concerning the appropriateness of including turbo-expanders within the self-generation program, based on Mafi-Trench's responses and the comments of interested parties.

For the reasons discussed in today's decision, Energy Division recommends that turbo-expanders not be eligible for any incentives under the program. The assigned Administrative Law Judge (ALJ) distributed Energy Division's recommendation to the parties for comment on August 6, 2003. No comments were filed in response.

For the reasons discussed in this decision, we deny Mafi-Trench's Petition to include turbo-expanders as an eligible project at any incentive level under our AB 970 self-generation program.

2. Background

"Self-generation" refers to distributed generation technologies (micro-turbines, small gas turbines, wind turbines, photovoltaics, fuel cells, and internal combustion engines) installed on the customer's side of the utility meter that provide electricity for either a portion or all of that customer's electric load. Under the program adopted in D.01-03-073, as modified by subsequent decisions, financial incentives are provided to three different categories (or levels) of distribution technologies:

Level 1: The lesser of 50% of project costs or \$4.50/watt for photovoltaics, wind turbines and fuel cells operating on renewable fuels;

Level 2: The lesser of 40% of project costs or \$2.50/watt for fuel cells operating on non-renewable fuel and utilizing sufficient waste heat recovery; and

Level 3: The lesser of 30% of project costs or \$1.00/watt for micro-turbines, internal combustion engines and small gas turbines operating on non-renewable fuel that both utilize sufficient waste heat recovery and meet reliability criteria. For these same technologies operating on renewable fuel: The lesser of 40% of project costs or \$1.50/watt.

The Commission authorized combined annual budgets of \$125 million for the self-generation programs administered by Pacific Gas and Electric Company (PG&E), Southern California Gas Company (SoCal), Southern California Edison Company (SCE), and San Diego Regional Energy Office (SDREO) over a four-year period.² The program was officially launched on June 29, 2001.

On April 24, 2002, Mafi-Trench filed a Petition requesting that the Commission permit turbo-expanders to qualify for the Level 1 incentive payments under the program. In its Petition, Mafi-Trench argued that turbo-expanders represent a “super clean” resource because there are no emissions resulting from the pressure drop that enables the technology to produce

² PG&E, SoCal and SCE are the program administrators for the self-generation program within their service territories. Per D.01-06-035, San Diego Gas & Electric Company (SDG&E) subcontracts to SDREO to administer the self-generation program within its service territory.

electrical power. Therefore, Mafi-Trench argued that this technology should be eligible for the higher incentives offered under Level 1.

In D.03-01-006, we denied Mafi-Trench's Petition without prejudice. We stated that turbo-generators could be considered eligible for Level 3 non-renewable incentives, depending on the efficiency of turbo-expander generation and project costs.³ We deferred final consideration of this issue pending the receipt and consideration of Mafi-Trench's responses to the following questions:

1. What are the installed system costs (on a dollar per kilowatt basis), both average costs and with project examples included?
2. What is the market potential for the application of this technology to recovery waste heat for the production of electrical power, both in terms of customer classes and total potential in California?
3. How would this application aid in peak load reduction and what is an average expected generation profile?
4. What efficiency does electrical power production from turbo-expanders achieve considering total inputs, including those required to produce the pressure differential in the first place, and what is the total energy use for compression stations in California?
5. How would this application meet the waste heat recovery and reliability requirements for Level 3 incentives, assuming it was eligible for incentives under that category?

³ D.03-01-006, p. 6; Finding of Fact 5.

6. How could this application be monitored to ensure that the turbo-expanders are used for electrical production and not a different industrial process once they are installed?

Mafi-Trench submitted a response to these questions on December 12, 2002, as part of its comments on the draft decision. In August 2003, Energy Division submitted its recommendations to the assigned ALJ and Assigned Commissioner in the form of a five-page report. By ruling dated August 6, 2003, the ALJ issued Energy Division's report for comment. No comments were filed in response.

Energy Division's report, which includes a summary of Mafi-Trench's December 12, 2002 response, is presented in Attachment 1.

3. Discussion

As noted in the attached report, Mafi-Trench's responses to our questions are very cursory. Nonetheless, they present a picture of a waste heat recovery technology that is a project component of natural gas production and transmission facilities. That is, turbo-expanders consume waste heat that is only made available through the generation and transmission of natural gas from other sources. While this may make turbo-expanders an advantageous waste heat recovery technology to a limited number of industrial users, it does not make it a stand-alone self-generation technology as contemplated under our AB 970 incentives program. We also note (as Energy Division does) that this project component appears to be quite expensive, relative to the total costs of non-renewable Level 3 self-generation technologies.

In its response to our question concerning energy efficiency, Mafi-Trench ignores our concerns over considering turbo-expanders in isolation by arguing

that “the normal consideration of efficiency is not necessary.”⁴ However, for the reasons stated in D.03-01-006, we believe that the energy inputs required to produce the pressure differential should be taken into account when evaluating the eligibility of this technology for self-generation incentives:

“In practice, turbo-expanders allow for the recovery of excess pressure in natural gas transmission to produce electrical power much in the same way (although by different processes) as co-generation units allow for the recovery of waste or process heat to produce electrical power. Both increase the efficiency with which fossil fuel inputs are utilized. However, neither technology can generate electricity in isolation, i.e., without fossil fuel inputs somewhere down the line. Natural gas pipelines require fossil-fueled compressors approximately every 50 to 100 miles to boost and maintain the high-pressure transmission that creates the pressure differential used to produce electrical power via turbo-expanders. *Were we to consider this technology eligible for self-generation incentives, we believe it is necessary to consider additional data on efficiency based on a broader definition of the energy inputs involved.*”⁵

By ignoring this fundamental issue, Mafi-Trench fails to present the information that we require in order to consider whether turbo-expanders qualify for Level 3 incentives. As we stated in D.01-03-073:

“The record lacks any data on the relative emissions of fuel cells (the only Level 1 technology with operational emissions) and turbo-expander generation when taking the fuel input requirements of compression stations into consideration. Therefore, nothing in the record compels us to equate turbo-expander generation in terms of air emissions with Level 1, Level 2 or Level 3 renewable technologies. However, this technology could be considered eligible

⁴ Comments of Mafi-Trench on the Draft Decision of ALJ Gottstein, December 12, 2002, p. 6.

⁵ D.03-01-006, pp. 5-6, emphasis added.

for Level 3 non-renewable incentives *depending on the efficiency characteristics of turbo-expander generation and the project costs.* As discussed above, we require additional information on these issues.”⁶

In conclusion, we find that turbo-expanders represent a waste heat recovery technology that cannot be considered in isolation for the purpose of evaluating its eligibility under our AB 970 self-generation incentives program. As Energy Division points out in its comments, including a discrete component of energy production projects in the self-generation incentives program would not be consistent with our policy to exclude the costs of other project components, such as processing equipment for renewable materials and nonrenewable fuels, fuel cleanup for nonrenewable fuels, and thermal load equipment that utilizes waste heat.⁷

Moreover, Mafi-Trench has not demonstrated that turbo-expanders qualify for Level 3 incentives based on the efficiency of the technology when it is not considered in isolation, i.e., in terms of total energy inputs, as D.03-01-006 requires. In addition, the information presented by Mafi-Trench indicates that the application of turbo-expanders is relatively limited. There is also very little data available to allow us to assess the costs, performance and benefits of completed projects. Considering the limited funding available for self-generation incentives, we concur with Energy Division’s assessment that it is not advisable to expend program funds for a technology that utilizes nonrenewable fuel and has relatively high costs per watt.

⁶ *Ibid.*, p. 6, emphasis added.

⁷ See D.02-09-051, pp. 15-16; D.02-02-026, pp. 11-12; and D.03-06-008, p. 3 and footnote 15.

For the above reasons, we deny Mafi-Trench's Petition to include turbo-expanders as an eligible project at any incentive level under our AB 970 self-generation incentive program.

4. Comments on Draft Decision

The draft decision of the ALJ in this matter was mailed to the parties in accordance with Pub. Util. Code § 311(g)(1) and Rule 77.7 of the Rules of Practice and Procedure. No comments were filed on the draft decision, and we adopt it without modification.

5. Assignment of Proceeding

Loretta Lynch is the Assigned Commissioner, and Meg Gottstein is the assigned Administrative Law Judge in this proceeding.

Findings of Fact

1. Turbo-expanders represent a waste heat recovery technology that cannot be considered in isolation for the purpose of evaluating its eligibility under our AB 970 self-generation incentives program.

2. Including a waste heat recovery project component of natural gas production and transmission facilities in the AB 970 self-generation incentives program would not be consistent with our decisions to exclude other project components, such as processing equipment for renewable materials and nonrenewable fuels, fuel cleanup for nonrenewable fuels, and thermal load equipment that utilizes waste heat.

3. Mafi-Trench has not demonstrated that turbo-expanders qualify for Level 3 incentives based on the efficiency of the technology when it is not considered in isolation, i.e., in terms of total energy inputs, as D.03-01-006 requires.

4. The application of turbo-expanders appears to be relatively limited.

5. There is very little data available with which to assess the costs, performance, and benefits of completed waste heat recovery projects that utilize turbo-expanders.

6. Mafi-Trench's Petition would require us to expend limited program funds for a technology that utilizes nonrenewable fuel and has relatively high costs per watt.

Conclusions of Law

1. Mafi-Trench's Petition to include turbo-expanders as an eligible project under our AB 970 self-generation incentive program should be denied.

2. In order to facilitate planning efforts under the AB 970 self-generation incentive program without any further uncertainty over the eligibility of turbo-expanders, this order should be effective today.

IT IS ORDERED that the Petition for Modification of Decision 01-03-073 filed by Mafi-Trench Corporation U.S.A. on April 24, 2002, is denied, with prejudice.

This order is effective today.

Dated December 18, 2003, at San Francisco, California.

MICHAEL R. PEEVEY

President

CARL W. WOOD

LORETTA M. LYNCH

GEOFFREY F. BROWN

SUSAN P. KENNEDY

Commissioners

ATTACHMENT 1

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**ENERGY DIVISION RECOMMENDATIONS CONCERNING
THE APPROPRIATENESS OF INCLUDING TURBO-EXPANDERS
IN THE SELF-GENERATION INCENTIVE PROGRAM**

August 2003

Introduction and Purpose

By Decision (D.) 03-01-006, the Commission directed the Energy Division to develop recommendations concerning the appropriateness of including turbo-expanders in the self-generation incentive program, and, if so, at which incentive level. Turbo-expanders may be used in place of throttling valves to step down high-pressure, transmission-level natural gas to lower pressures for customer usage at distribution level. The recovery of excess pressure can be used to produce electrical power.

Staff recommends that turbo-expanders not be considered eligible for incentives at any level.

Background

On April 24, 2002, Mafi-Trench Corporation U.S.A. (Mafi-Trench) filed a Petition for Modification of D.01-03-073 to permit turbo-expanders to qualify for Level 1 payments under the self-generation incentive program. The Commission denied the Petition, citing that turbo-expanders do not qualify as a “super-clean” technology, and that the Petition did not provide enough information to determine if turbo-expanders could qualify for Level 2 or Level 3 incentives. The Commission afforded Mafi-Trench the opportunity to respond to specific questions regarding installed system costs, market potential, ability to reduce

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peak demand, efficiencies, waste heat recovery, and monitoring. The Commission invited parties to comment on Mafi-Trench's subsequent filing.

Mafi-Trench submitted a response on December 12, 2002. No parties submitted comments to the filing.

Mafi-Trench's Response

Mafi-Trench describes how turbo-expander-based generating systems lower natural gas pressure from transmission levels to pressure suitable for use by large industrial facilities. As the turbo-expander steps down the pressure, the temperature of natural gas decreases. In an example provided by Mafi-Trench, the stepped-down natural gas is used to fuel steam generators. Waste heat from the flue gas stream of the boilers could be used to heat the natural gas to the required temperature, which would obviate the need for additional fuel.

Installed Costs

Mafi-Trench indicates that installed costs for a turbo-expander are dependent on the size of the project. Costs range from a low of \$2.50 per watt for a one megawatt (MW) project to \$8.00 per watt for a 100 per kilowatt (kW) system. Mafi-Trench estimates an installed system cost of \$4/watt for an oil field project near Bakersfield. The project is expected to produce 500 kW on a continuous basis, for an annual savings of 4,000 MW per year. It is unclear whether eligible generator costs are included in these estimates.

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We note that in 2002, the average cost of a Level 3-N microturbine is \$2.69/watt.⁸ We estimate the average cost for a Level 3-N internal combustion engine is approximately \$2.16.

Market Potential

According to Mafi-Trench, potential customers for turbo-expander-based power recovery systems are pipeline operators and industrial facilities which use natural gas to produce steam or other forms of process heat, such as manufacturers of steel, glass, aluminum, gypsum, and petrochemicals. Mafi-Trench estimates there are between 100 and 300 candidate sites which could produce an average of 200kW per site, for a potential of 400 MW of generation.

Peak Load Reduction

The turbo expander will operate only when the industrial facility is operating and consuming natural gas. Mafi-Trench indicates turbo-expanders will generally reduce the facility's peak demand.

Efficiency

Mafi-Trench states it is not necessary to consider the total energy input into the natural gas system to estimate the efficiency of turbo-expanders versus traditional pressure regulating stations. Compression energy input to the transmission and distribution systems is necessary to operate these delivery

⁸ California Self-Generation Incentives Program – Second Year Impacts Evaluation Report, April 2003, Tables 9-11.

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systems, and is independent of whether the pressure “energy” is recovered at the point of use. Normal consideration of efficiency is not necessary, as turbo-expanders do not use additional fuel for combustion, just waste heat that would normally be discarded.

Waste Heat Recovery and Reliability Requirements

Mafi-Trench contends that its proposed system exceeds the waste heat recovery requirements of Level 3 because it consumes waste heat and does not require fuel combustion. In contrast, microturbines combust fuel and produce waste heat.

Mafi-Trench indicates that its proposed system has a demonstrated availability of approximately 99% +/-0.5%, which equals or betters most combustion turbines.

Compliance Monitoring

Mafi-Trench believes turbo-expanders could be monitored in the same manner as other eligible technologies, to ensure the units are being used for their stated purpose: electrical production.

Energy Division Recommendations

We recommend the Commission deny the Petition to include turbo-expanders as an eligible project cost at any incentive level. This determination is consistent with prior Energy Division recommendations adopted by the Commission to exclude costs of project components such as processing

equipment for renewable materials and nonrenewable fuels, fuel cleanup for nonrenewable fuels (such as waste gases derived from fossil fuel drilling

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operations), and thermal load equipment that utilizes waste heat. The Commission determined that these components are discrete and separate from the generation facility. Energy Division believes turbo-expanders also fall within this category.

Considering the limited funding available for self-generation incentives, we do not believe it is practical to expend program funds for a technology which utilizes nonrenewable fuel and has relatively high costs per watt. As with other technologies, turbo-expander system costs per watt are higher for smaller projects. Mafi-Trench estimates an average project size of 200kW. Given that estimated system costs for the 500kW project near Bakersfield are approximately \$4.00/watt, system costs per watt are likely to be even higher for the proposed 200kW systems.

Mafi-Trench observes that although the technology is readily available, it is not widely used due to regulatory and economic considerations. The low penetration rate may also be attributed to the limited market for the technology. Consequently, there is very little data available to allow us to adequately assess the costs, performance, and benefits of completed projects. We believe Mafi-Trench was constrained by this lack of data as well.

(END OF ATTACHMENT)